Social Play and Engagement as an Outcome of Peer-Mediated Interventions for Students with Autism Spectrum Disorder

By

Todd M. Miller, Ed.S.

Submitted to the Department of Psychology and Research in Education and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Kathy Thiemann-Bourque (Co-Chair)

_____
Steven Lee (Co-Chair)

_____
Richard Simpson

_____
Matthew Reynolds

_____
Meagan Patterson

Date Defended:_____

The Dissertation Committee for Todd M. Miller certifies that this is the approved version of the following dissertation:

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Kathy Thiemann-Bourque (Co-Chair)

Steven Lee (Co-Chair)

Richard Simpson

Matthew Reynolds

Meagan Patterson

Date Approved:

ABSTRACT

This study evaluated the effects of a peer-mediated intervention on the social play and engagement of students with autism spectrum disorder (ASD). Twenty students with ASD and typically developing peers participated in a systematic social skills intervention during Kindergarten and First Grade, completing standardized social probes designed to measure unstructured social interactions independent of the instructional intervention sessions. Rates of engagement with typically developing peers during baseline and post-intervention social probes were measured using a hierarchical scale of social play and engagement. Analysis focused on improvements in the observed rates of social behaviors, including increases in cooperative forms of play, decreases in solitary or unengaged forms of play, and identifying unique within-session patterns of responding across different states of engagement. Implications for the design of social skills interventions and measurement of social play behaviors are discussed.

Acknowledgements

As I quickly learned when beginning this project, a dissertation is far from an individual accomplishment but rather the collective product of collaboration and mentorship. I am grateful to my committee members, Kathy Thiemann-Bourque, Steven Lee, Richard Simpson, Matthew Reynolds, and Meagan Patterson for their support and guidance during this project and throughout my graduate education. I am especially appreciative of my four years working at Juniper Gardens Children's Project, which provided the starting point for this project and also played a significant role in my training and development as a professional and researcher.

I am incredibly appreciative of my parents for their unending support and encouragement throughout my education, and to my extended family in Boston for their hospitality over the past year while the majority of this work was completed. I am also thankful to my colleagues at the May Institute for their valuable training and mentorship over the past year, and to Katie Meyer in assisting with coding videos. To my brother, Alex, for providing much needed perspective and advice on navigating graduate school, and to my sister Lisa, who continues to inspire me in more ways than I could ever explain, thank you.

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Social Play and Engagement as an Outcome of Peer-Mediated Interventions for Students with Autism Spectrum Disorder

Deficits in social communication and interaction are among the core characteristics of individuals with autism spectrum disorders (ASD; American Psychiatric Association, 2012). Children with ASD also show social deficits in the use of verbal and nonverbal behaviors during peer interactions and in the use of age-appropriate play skills (National Research Council, 2001). Specifically, children with ASD commonly show impairments in the use of pretend play skills (Loveland & Kotoski, 2005), and engage in more solitary or non-play behaviors than students without disabilities (Kim et al., 2003). Additionally, children with ASD may predominately engage in nonsocial play in comparison to typically developing children or those with other types of developmental disabilities (Sigman & Ruskin, 1999). As a result of these skill deficits, children with ASD are at an increased risk for social isolation and peer rejection throughout the early elementary years (Odom et al., 2006). These deficits illustrate the need to identify effective and sustainable intervention programs targeting play skills to increase social competence in children with ASD.

The predominant intervention strategy for teaching social skills to children with ASD includes systematic and explicit instruction of appropriate social communication behaviors, such as orienting towards others, establishing and maintaining eye contact, and initiating and sustaining age-appropriate conversations (Bellini, Peters, Benner, & Hopf, 2007; Dawson & Osterling, 1997; Strain, Schwartz, & Bovey, 2000). The instructional strategies included in these interventions include child-specific methods (i.e., social scripts, visual cues, or prompts delivered by a therapist or teacher), or environmental

modifications (i.e., accessible materials, integrated playgroups without instruction; McConnell, 2002). A common critique of many social interventions, however, is the failure of skills acquired in structured teaching sessions or specific settings to generalize to naturally occurring social interactions (Hwang & Hughes, 2000). Peer-mediated interventions are an alternative approach to social skills instruction, and are among the most commonly studied and supported strategies for children with ASD (National Research Council, 2001; National Standards Project, 2007). Peer-mediated interventions utilize typically developing peers as conversational partners and agents of delivering instruction to improve social interactions with children with ASD (Odom & Strain, 1984). Through systematic teaching, modeling, and reinforcement delivered through small group instruction with peers, children with ASD are provided with increased opportunities to practice and acquire age-appropriate social skills (Haring & Breen, 1992). Research supports peer-mediated interventions as an effective strategy for increasing rates of communication between children with ASD and their peers in natural social and educational settings (Kamps et al., 1997; Thiemann & Goldstein, 2004).

Although peer-mediated interventions provide a promising example of a social skills intervention for students with ASD, several pertinent issues remain unaddressed throughout the social skills literature. Most notably, there is little agreement across studies regarding the variables or categories that should serve as behavioral outcomes for social skills interventions (Odom & Ogawa, 1992; Reichow & Volkmar, 2010). Wolery and Garfinkle (2002) found that although specific language and communicative behaviors (i.e. initiations and responses) are well studied, other core deficits associated with ASD are understudied as treatment outcomes. These areas included more complex

characteristics of play (i.e. pretend and/or symbolic play skills) and social engagement with peers (Dawson & Osterling, 1997). Similar concerns regarding appropriate outcome measure have been raised when considering the complex heterogeneity and verbal abilities that characterize many children with ASD. Bellini (2009) gave several reasons why the proportion of time spent socially engaged might be a more appropriate outcome measure than specific social communication behaviors for many students with ASD. For example, solely focusing on increasing the frequency of initiations may be an inappropriate social goal for a student with ASD with high verbal skills whose social difficulties may assume different forms (i.e., stereotypy, or initiating on the same repeated topic, or perseveration). Additionally, the number of initiations made by a child may actually decrease over time if social bids are successful in leading to longer social interactions featuring multiple conversational responses, rather than requiring new initiations (Bellini, 2009). Collectively, these issues suggest that increased study of the social engagement of children with ASD through multiple dimensions is warranted to better understand intervention outcomes that may not be captured by existing measures.

Social engagement has been variously defined and measured throughout the literature. The NRC defined engagement as "sustained attention to an activity or person" (p. 160) and an essential component of interventions for children with ASD that may be taught explicitly or implicitly (NRC, 2001). Early studies focused on childhood engagement measured the percentage of time spent engaged in planned activities (McClanahan & Risley, 1975; Montes & Risley, 1975; Twardosz, Cataldo, & Risley, 1974), and reported that environmental arrangements and teaching methods were critical determinants of engagement. Later research used engagement as the basis for designing

optimal classroom environments (Jones & Warren, 1991; Ostrosky & Kaiser, 1991; Twardosz & Risley, 1982). These studies primarily used a dichotomous definition of engagement, in which a student's behavior was either described as engaged or unengaged, without further analysis of behavioral characteristics. Several peer-mediated interventions for students with ASD have included a similar dichotomy of engagement as an outcome of treatment effects (Kamps et al, 2002; Koegel, et al., 2012; Parker & Kamps, 2011), indicating positive changes in the amount of time spent engaged following intervention.

An alternative approach shifts away from assessing engagement strictly as a dichotomous construct, and towards assessing engagement as a hierarchical construct featuring discrete levels of social participation. McWilliam and Bailey (1986) originally described an approach to assessing engagement that included multiple targets of attention (adults, peers, materials, or nonengagement) and multiple levels of engagement (attentional or interactive) rather than a traditional dichotomy in which behavior is either engaged or disengaged. Subsequent studies have used similar methods to understand how forms of social engagement in children may change across developmental ages (de Kruit & McWilliam, 1999), types of activities (McCormick, Noonan, & Heck, 1998), and different settings (McWilliam & Bailey, 1995). Other approaches to measuring social engagement as a multidimensional construct draw upon the levels of social participation (unoccupied, onlooker, solitary, parallel, associative, or cooperative) originally described in Mildred Parten's seminal study of childhood social play (Parten, 1932). Components of Parten's hierarchy were later integrated into more sophisticated coding schemes to further study social participation and play in typically developing children (Smith, 1978;

Bakeman & Brownlee, 1980). A key development among these subsequent studies was the use of sequential analysis to discover relationships between different states of play or engagement during a single observational session. For example, Bakeman & Brownlee (1980) found that preschool children often engage in parallel play immediately prior to beginning a cooperative group activity with peers. Further refinements to observational systems of play have integrated aspects of Parten's original coding scheme with characteristics of cognitive play (Smilansky, 1968), including functional, constructive, symbolic, or rule-based engagement (Rubin, 2001).

In addition to descriptive analyses of social engagement, sequential analysis enables an understanding of the common or uncommon paths or transitions between states of engagement. Guralnick and colleagues have conducted a series of studies focused on the analyses of social interaction between typically developing peers and students with various disabilities, revealing key similarities and differences regarding the structure of these interactions. For example, Guralnick and Hammond (1999) conducted a sequential analysis of play states in preschool children with and without developmental delays, finding that children with developmental delays transitioned from parallel to group play less often than typically developing peers. In a related study, Guralnick, Conner, and Johnson (2011) found that although children with Down syndrome show levels of social interest comparable to typically-developing peers, these interactions are often unsuccessful without adult guidance and support. In a study of peer interactions with students with communication disorders, Guralnick, Hammond, and Connor (2006) found that preschool students with communication disorders engage in similar patterns of social play to their peers, despite the associated social and communicative deficits of their

disorders. Although these studies offer some promise in understanding the structure of peer interactions featuring students with various disabilities, researchers have long emphasized the need to refine the methodology used to study social engagement (Odom, Favazza, Brown, & Horn, 2000) and increase the use of sequential methods in studying social interaction (Odom & Ogawa, 1991). Examining the application of these refined analytic methods to social skill interventions for students with ASD will continue to build an evidence base for comprehensive programs with outcomes designed to impact social and play skill development. In summary, the social engagement of children with ASD is a critical dimension of social competence and either a direct or collateral target of many common social skills interventions. The precise analysis of social play and engagement of children with ASD is necessary to develop both effective and ecologically valid intervention strategies.

Purpose and Research Questions

The current study addressed the described gaps in the literature by evaluating the social engagement and play skills of children with ASD who participated in a peer-mediated intervention during Kindergarten and First Grade. Although existing measures of social-communication outcomes of peer-mediated interventions have reported positive changes in the frequency of initiations and responses within peer social interactions (Kamps et al., 2002), additional outcome measures may be necessary to capture other, less reported social and behavioral changes. Specifically, there are no known studies assessing the social play and engagement of children with ASD following participation in small peer groups using engagement as a multilevel construct, similar to the methodological approach employed by Guralnick and Hammond (1999). Additionally,

there are no known studies using a multilevel definition of social engagement as an outcome of peer-mediated interventions. The findings of the present study could make a valuable contribution to the intervention literature regarding specific types and levels of social play and engagement that characterize the interactions between children with ASD and their peers in the early elementary grades. The research questions included:

1) What are the observed changes in overall rates of social play and engagement for students with ASD following participation in a peer-mediated intervention?

2) What are the observed within-subject changes in social play and engagement for students with ASD following participation in a peer-mediated intervention?

3) What are the within-session sequences of social-play and engagement in students with ASD before and after participation in a peer-mediated intervention?

Literature Review

Social Play and Engagement as a Developmental Construct

Play has been defined as the purposeful manipulation of objects in which children learn to practice a wide variety of skills in their social environment (Coplan, Rubin, & Findlay, 2006). The role of social interactions with others has been hypothesized to drive social, emotional, and cognitive development in young children, and has been included as a core component of several preeminent developmental researchers and theorists (Bruner, 1972; Piaget, 1962). The acquisition of social skills during early childhood occurs in several ways. Beginning in infancy, parent-child interactions provide an initial foundation of skills, which are later refined and become more complex through socializing with same-age peers during recreational and educational activities (Garner & Began, 2006). Reciprocal social play emerges within the first year of an infant's life,

with joint attention skills indicating a child can alternate eye-gaze or show objects with others (McTear, 1985). Later early childhood play skills include the ability to spontaneously request, to comment, or to engage in spontaneous social conversations. Through repeated practice using these skills, children learn acceptable patterns of social behavior and improve both verbal and nonverbal communication skills to refine their social skills (Goldman, 1998).

As children begin formal schooling, there are increased behavioral expectations for social interactions with peers or other adults. In particular, the start of Kindergarten represents a significant developmental milestone and transition for all young children. This shift notably includes regular interactions in a setting where the rules, routines, expectations, and activities may differ significantly from those previously experienced by children in early childhood or home settings (Shore, 1998). In particular, the time spent in close proximity to same-age peers increases substantially, requiring repeated use of a child's *social competence* skills to navigate these interactions. Social competence is a broad term used to describe a variety of skills necessary for successful interpersonal interactions across settings and individuals (Dodge et al. 1986). Social competence has been variously defined as a multidimensional construct that encompasses the ways in which individuals behave while in contact with others (Hartup, 1983), and as a composite variable used to describe social adjustment, social performance, and social skills (Cavell, 1990). Among the most commonly observed characteristics of social competence are the number of verbal exchanges between peers, mutual participation in spontaneous play, and giving of positive reinforcement (Odom & Igawa, 1992). Children demonstrating high social competence select appropriate and effective behavioral strategies, are accepted

amongst their peers, and develop reciprocal friendships at a young age (Vaughn, Colvin, Azria, Caya, & Krzysik, 2001). In contrast, children demonstrating low social competence may be highly aggressive towards peers, socially withdrawn or isolated, or rejected or ignored by their peers (Odom, McConnell, & Brown, 2001). The failure to develop positive peer relationships in early childhood settings has also been associated with similar difficulties later in elementary school, decreased academic performance, and poor social adjustment in adolescence and adulthood (Ladd, Buhs, & Troop, 2002).

Mildred Parten (1932) developed perhaps the most influential and well-known coding scheme for childhood social behavior in a classic study of childhood play. Parten's observational framework included two categories of socially engaged play and four categories of non-social play. *Cooperative play* was used to describe the most actively engaged state of social play, consisting of an organized group activity for the purpose of achieving a common goal. Other observable aspects of cooperative play include mutual turn taking between peers and coordinated multistep actions during activities. *Associative play* is the second category of socially interactive play, and was described as a student playing with another child using similar materials, but without a clearly observable purpose or goal to the interactions. Although associative play may include verbal exchanges and comments between peers, the interactions are not associated with a shared activity or a component of a more complex social interaction. Parten's observational framework also included multiple categories of non-social play to describe the behaviors of student who are not actively engaged in social interactions. *Parallel play* was described as a student playing alongside but not with another student, often featuring the use of parallel speech, or non-specific verbalizations that are directed

towards a peer. *Solitary play* was described as a student engaging in an activity independently while paying little or no attention towards others. *Onlooker play* was described as students actively observing and watching the play of those around them, but not engaging or participating in the behavior themselves. Finally, *unengaged play* was described as a student not actively engaged at all with their peers or an activity, who may appear without purpose during observations.

The legacy of Parten's work remains apparent by the subsequent studies that have continued to use core features of her original observational framework while making subtle refinements to the coding scheme (Bakeman & Gottman, 1997; Smith 1978). A notable recent example is the *Play Observation Scale* (POS, Rubin, 2001), which includes 10-s interval time sampling of child behaviors and combines Parten's states of social participation with aspects of cognitive play (e.g. functional, symbolic, sociodramatic) described by Smilansky (1968). Variations on the coding scheme have also led to an expanded understanding of various states of nonsocial play, such as reticent behavior, solitary-passive, and solitary-active states of social engagement (Rubin, Burgess, & Hastings, 2002). Through careful analysis of these structural aspects of childhood social play, researchers have also discovered the influence of multiple variables on social participation with peers, including socioeconomic status, parental styles, and play settings (Mills & Rubin, 1998; Rubin et al., 2001). For example, parents of children who are socially accepted by their peers have been shown to primarily use authoritative parenting techniques, in which high parental demands are paired with high social responsiveness (Mize & Pettit, 1997). In contrast, parents of socially rejected children may be more likely to use authoritarian disciplinary techniques, in which parents

are more demanding and less responsive to their child's needs (McDowell & Park, 2000). Related studies assessing childhood play have also shown non-social play and engagement in early childhood may lead to a variety of negative outcomes in later childhood and adolescence, including internalizing disorders, disruptive behaviors, and social withdrawal (Cheah, Nelson, & Rubin, 2001). Nonsocial play is hypothesized to lead to these negative outcomes through reduced opportunities to practice age appropriate social skills with others, a decreased preference for social activities, and an increased engagement in primarily nonsocial activities.

In addition to the developmental influences and outcomes associated with social engagement, several researchers have focused on describing the relationship between social engagement and broader cognitive skills. In particular, these have included hypotheses regarding the association between different forms of play and problem solving skills, creativity, and critical thinking (Tsao, 2002). Researchers have traditionally proposed that hierarchical nature of social participation would mirror cognitive development, with lower forms of social participation in Parten's hierarchy similarly being associated with less sophisticated problem solving or cognitive skills (Rubin, Bukowski, & Parker, 2006). Cooperative engagement with peers provides exposure to the thoughts, opinions, ideas, and feelings of others, enabling a more inclusive and less egocentric points of view (Coolahan, Fantuzzo, Mendez, & McDermott, 2000). Additionally, frequent exposure and engagement with a variety of peers has been hypothesized to provide a foundation for conflict-resolution, cooperative learning, and organizational skills (Topping & Ehly, 1998). These studies have largely

supported Parten's original interpretation of social participation as becoming both more complex and more developmentally beneficial at higher levels of the hierarchy.

Several alternative interpretations of the hierarchical nature of social participation, however, have also been proposed. For example, Moore, Evertson, and Brody (1974) proposed that solitary play may not be the result of social immaturity, but is rather a positive and desirable class of behaviors driven by a strong motivation for individual goal attainment and purposeful activities. In contrast, cooperative play may be indicative of children who are highly agreeable with peers, but without individualistic intent to their play. Parallel or onlooker play, they proposed, may alternatively be the least cognitively advanced form of play, indicative of children who were interested in making social contact with peers but did not have the social, pragmatic, or linguistic skills required to do so. Subsequent research, however, has largely dismissed these alternative interpretations and identified several development benefits of cooperative play. For example, on isolated problem solving tasks, children have been found to be more successful when working collaboratively with peers than when alone (Golbeck, 1998; MacDonald, Miell, & Morgan, 2000). In summary, these studies illustrate the developmental importance of social participation and engagement with peers.

Social Play and Engagement in Autism Spectrum Disorders

Autism spectrum disorders (ASDs) have been defined by deficits in social interaction since Kanner's (1943) original description of the disorder. In contrast to typically developing children who naturally acquire many social communication skills, children with ASD often fail to initiate spontaneous social interactions towards others or comprehend the communicative attempts made to them by others (Spradlin & Bradley,

1999). In addition to deficits in social interaction, individuals with ASD are characterized by deficits in receptive and expressive communication, and a restricted or repetitive set of behaviors or interests. The Diagnostic and Statistical Manual - Fifth Edition (DSM-V, 2013) criteria for autism spectrum disorder includes multiple symptoms that adversely impact social interactions with others. These include deficits in social-emotional reciprocity, reduced sharing of interests, poorly integrated verbal and nonverbal communication, poor eye contact, and difficulties sharing in imaginative play or making friends. In addition to the social deficits defined by DSM-V, the presence of restricted or repetitive interests may include stereotyped motor movements, insistence on routine or sameness, highly fixated interests or focus, and strong reactivity to various sensory stimuli. While there is variability among those children diagnosed with ASD, collectively, these impairments demonstrate the significant challenges faced by students with ASD in their social development and the impact of the disorder on social play and engagement.

In early childhood, the behavioral manifestations of ASD are often initially apparent during parent-child interactions. Delays in communication or language development are considered one of the earliest markers of ASD, with many parents reporting initial communication delays as the primary concern in their child's development (Koegel & Koegel, 2001). Young children with ASD are also characterized by lacking joint-attention, or shared interactions between another individual and an object of interest. These deficits preclude many children with ASD from engaging in age-appropriate play or activities from an early age, and prevent opportunities to further refine social competence. In addition to deficits in age-appropriate play skills, children

with ASD may demonstrate restricted or repetitive behaviors. These may include obsessive interests, stereotypy, adherence to non-functional play routines, or insistence on particular patterns of play, which frequently interfere with typical patterns of social interaction (Loftin, Odom, & Lantz, 2008). Therefore, many students with ASD entering inclusive early childhood or school settings lack the expected set of appropriate play skills, and are at a significant developmental disadvantage in comparison to typically developing peers. When observed during free-play activities with typically developing peers, students with ASD rarely initiate social interactions, and often engage in isolated play away from other students (Sigman & Ruskin, 1999). In addition to initiating fewer social interactions with others, the unresponsiveness of students with ASD to the social bids of others may discourage peers from attempting future interactions, leading to increased peer rejection or social isolation (Strain & Hoyson, 2000).

The long-term outcomes for students with ASD are similarly discouraging. As students with autism enter secondary educational settings, increased academic demands within the general education curriculum may prevent continued inclusive placements, reducing opportunities for peer interaction. Moreover, secondary-age students with ASD have reported an increased interest or desire in making friends, yet feel they do not have the social skills required to do so (McGovern & Sigman, 2005). Collectively, these deficits emphasize the importance of early, systematic intervention to facilitate the development of age-appropriate play skills and social engagement. Interventions that successfully address the described social deficits of ASD and facilitate the development of meaningful social relationships and social competence are a clear priority for both educators and researchers.

Peer-Mediated Intervention Strategies

Addressing the social-communication deficits of ASD has led to a litany of varying treatment approaches. Early attempts at remediating deficient social behaviors of students with ASD included the use of adults to mediate and provide reinforcement during interactions between a child with ASD and their peers (Strain & Odom, 1986). Although other adult-led interventions have been successful in reducing the undesirable behaviors of children with ASD and increasing compliance to explicit instructional requests, they have been less successful in promoting the use of age appropriate social skills in natural environments (Rogers, 2000). An alternative approach to social intervention developed by Strain and colleagues over the past 30 years involves a systematic method of teaching typically developing peers to initiate, reinforce, and maintain social interactions with students with autism. These approaches, called peer-mediated interventions, have been used successfully across multiple studies to increase the sharing of materials, organization of play episodes, functional communication during game play, and sustained social interactions between young children with ASD and their classroom peers (Morrison, Kamps, Garcia, & Parker, 2001; Thiemann & Goldstein, 2001; 2004; Weiss & Harris, 2001).

Although characteristics of peer-mediated interventions vary across studies, several core characteristics guide implementation. These include the emphasis on increasing *initiations* between students with ASD and typically developing peers. The initial study evaluating peer-mediated interventions (Strain, 1979) included training a typically developing peer to initiate social interactions to two students with ASD, resulting in an overall increase in the social communication between students.

Subsequent studies conducted by Strain and colleagues expanded the role of the typically developing peer to provide reinforcement, prompting, and tutoring to young children with ASD to promote social interactions and competence in natural social settings.

The structure of peer-mediated intervention sessions typically takes the form of small groups meeting multiple times per week, led by an adult therapist with two to three typically developing peers and a target student with ASD (Haring & Breen, 1992). Sessions are designed to systematically target specific social skills, often moving through a sequence from simpler to more complex skills. For example, Thiemann and Goldstein (2004) completed a 12-week program in which four elementary-age students with ASD progressed through a series of skills initially targeting initiations, followed by social niceties, compliments, suggestions, and securing attention. Following introduction of a target skill by the therapist, session activities included multiple role-plays in which all children explicitly practiced performing targeted skills with guided feedback from adults or other peers. The multiple demonstrations of different social skills and repeated models of appropriate skill use are provided for students with ASD to observe appropriate skill use (Haring & Breen, 1992). Following role-plays, intervention effects are then observed during free-play or a guided activity in which the adult or peer may provide reinforcement for appropriate skill use. During sessions, visual aids to provide examples or prompt skill use and social interaction are often utilized, providing consistent access to contextually relevant and socially appropriate communicative statements (Thiemann & Goldstein, 2001; Thiemann & Goldstein, 2004).

Studies utilizing a peer-mediated methodology have produced a variety of positive outcomes for students with autism. For example, Kamps et al. (1997) utilized

peer networks across multiple school settings (i.e., centers, academic work, recess, and lunch) for three elementary-age students with ASD. They reported that the use of peer training and reinforcement increased social interactions and engagement across these common educational settings. During the course of a five-year longitudinal study for 45 children with ASD, Kamps et al. (2002) found that peer-mediated intervention increased the on-topic language and interest in peer interaction of students with ASD. The use of peer-mediated interventions has also been supported for students who use augmentative communication devices (Garrison-Harrell, Kamps, & Kravits, 1997), and in the generalization of social skills to community based settings and activities (Parker & Kamps, 2011).

Several comprehensive and systematic literature reviews have also supported the use of peer-mediated interventions for young children with ASD. In a comprehensive review of ASD treatments across the past 60 years, the National Standards Project (2007) classified intervention programs as either established, emerging, unsupported, or harmful in accordance with the degree of empirical support. Peer-mediated packages were one of eleven treatments to receive an established designation in support of their effectiveness in support of students with ASD. Chan et al. (2007) conducted a systematic review of 42 peer-mediated interventions for students with ASD, finding that 91% of studies reported positive student outcomes. Additionally, studies that included a measure of ecological or social validity indicated that peer-mediated interventions were considered an acceptable and effective intervention to teachers, students, and their families. A notable concern reported in the review, however, indicated that only 50% of peer-mediated studies have included a measure of treatment integrity, emphasizing a need to interpret the overall

positive results with caution and expand the evaluation of treatment integrity in future studies of peer-mediated interventions. Collectively, the existing literature indicates the promise of peer-mediated instructional strategies for students with ASD and the need to continue studying these approaches as an evidence-based intervention.

Measuring Social Behavior and Intervention Outcomes

Although social interventions for students with ASD have generally indicated positive findings, several issues remain unaddressed. In addition to concerns regarding treatment integrity, treatment dosage, and program quality, meta-analytic reviews have noted the dissimilarity in outcome measures used in ASD research (Bolte & Diehl, 2013; Reichow & Volkmar, 2010; Wolery & Garfinkle, 2002;). In Ivar Lovaas' seminal study of early-intensive behavioral intervention (Lovaas, 1989), outcomes were determined by changes in student intellectual functioning, as determined by cognitive assessments. Many studies, particularly larger randomized clinical trials similar to the Lovaas (1989) study, continue to use change as indicated by intelligence tests as primary determinants of outcomes. A number of concerns, however, have arisen regarding the use of intelligence tests as outcome measures for students with ASD, primarily due to the lack of normative samples of the population and the frequent comorbidity of intellectual, developmental, and language impairments in many children with ASD (Klin, Saulnier, Tsatsanis, & Volkamar, 2005). In response to these concerns, other studies have broadened the targeted outcomes of interventions to include more behavioral or functional indicators of change. This predominately includes a large body of research drawing from the field of applied behavior analysis, which emphasizes selecting precise behavioral targets for intervention and change, including social behavior, communication skills, and peer interactions (Strain & Schwartz, 2001).

Several recent reviews have highlighted similar concerns regarding the specific measurement tools and outcome variables used as indicators of progress in ASD interventions. Bolte and Diehl (2013) reviewed the measurement tools used in 195 intervention studies for children with ASD conducted between 2001 and 2010, finding that 61.9% of measurement tools were only used in one study, with 20.8% of measurement tools being investigator-designed. Wolery and Garfinkle (2002) reviewed the outcome measures used in 63 studies of social intervention programs for young children with autism, finding that although social-communication is well studied as an outcome of intervention, other core skills are far less studied. Discrete use of social skills and social communication were targets of intervention across 65.1% of reviewed studies. In contrast, play and engagement were targeted by only 10% of the reviewed studies. In their discussion, Wolery and Garfinkle (2002) emphasized the importance of continuing to expand the targeted intervention outcomes to include other social domains impacted by ASD, including play and engagement. Strain, Schwartz, and Barton (2011) emphasized similar themes in calling for a broadening the scope of intervention outcomes to include other skills, such as independent play, attending, and adaptive functioning, relevant to daily life. For students with autism, the importance of measuring social play may be particularly important, considering the impact of the disorder in precluding meaningful engagement in peer interactions. Although several peer-mediated studies have noted improvements in social engagement when measured as a dichotomous variable (Kamps et al., 1997), the multilevel approaches to assessing engagement (Guralnick & Hammond, 1997; Rubin, 2001) have not yet been utilized as an outcome of peer-mediated interventions for students with ASD.

Although researchers have employed a variety of methods to assess these social constructs (i.e. sociometric ratings, standardized assessments, questionnaires, etc.), direct observation is the prevailing and dominant methodology used to assess social behavior and interactions (Odom & Igawa, 1992; Thompson, Felce, & Symons, 2000). The accurate assessment of social skills in children through direct observation, however, presents several unique challenges. Notably, social interactions are a complex and multilayered phenomenon. Social interaction is reciprocal by nature and developing appropriate coding schemes to capture this unique structural characteristic of socialization is challenging (Odom & Igawa, 1992). Researchers have developed several strategies to address these complexities. Bellini (2009) described a novel approach to assessing one aspect of social communication in students with ASD by calculating a *response ratio* during interactions with typically developing peers. The response ratio is calculated by dividing the number of responses from a student with ASD by the total number of peer initiations made to the student, and accounts for variability in opportunities to respond that occurs when utilizing different peers during sessions. In his discussion, Bellini speculated that using a response-ratio or other refined methods of assessing idiosyncratic social behaviors could be a more appropriate way to develop individualized interventions and social strategies.

Another promising approach to analyzing social interactions integrates Parten's codes of social participation with modern methods of observational analysis. Parten's (1932) initial interpretation of social participation suggested that children would progress through stages of social engagement over time and developmental milestones. For example, 3-year olds were presumed to primarily engage in parallel or solitary play,

while 5-year olds were presumed to primarily engage in associative or cooperative play. Contemporary studies using variations on Parten's (1932) observational scheme and the *POS* (Rubin, 2001) have instead revealed that children regularly transition among and between different states of social play and engagement within a single observation. This methodological approach enables a nuanced analysis of within-session or within-subject changes between states of play, and the likely or unlikely transitions between states of social engagement. For example, Guralnick and Hammond (1999) noted that although preschoolers with developmental delays make many of the same transitions between play states as typically developing peers, they are significantly less likely to transition from parallel-to-group play, preventing increased social play.

Considering the importance of developing social competence in childhood and the troubling developmental outcomes of students with ASD, childhood play and social engagement with peers is a critical concept for researchers and educators to investigate further. There are several reasons that illustrate why examining social play and engagement as an outcome for peer-mediated interventions for children with ASD is appropriate, and would complement the results obtained from an analysis of frequency of communication. First, many of the skills frequently targeted during peer-mediated interventions would directly result in higher degrees of cooperative or interactive play. For example, the use of play-organizers, or statements that set rules, parameters, and roles for group play are commonly included in peer-mediated interventions (Sainato, Goldstein, & Strain, 1992). The use of play-organizers would also be consistent with traditional and contemporary definitions of cooperative play (Guralnick & Hammond, 1999; Parten, 1932; Rubin, 2001;), which includes setting objectives, defining rules, and

identifying a purpose to an activity. Thus, the systematic instruction of social skills delivered via a peer-mediated intervention may result in higher rates of observed cooperative play. Additionally, students with ASD are characterized by highly heterogeneous verbal abilities, with a range of deficits commonly observed across receptive and expressive domains (Paul, 2005). Although students with ASD may show increased social interest and awareness following a social skills intervention, limited verbal abilities or communication skills may preclude these changes from being captured through outcome measures based solely on frequency of communication. In contrast, students with ASD who have higher verbal skills may show a high frequency of communication during baseline, yet may have significant social difficulties in the more complex areas of social pragmatics, verbal comprehension, and perspective-taking, precluding cooperative play. Skills included in peer-mediated intervention, such as requesting and sharing objects with others or commenting on the behaviors or interests of others, may improve the observed rates of cooperative play during these interactions without altering the frequency of communicative interactions. In order to address these challenges, using an outcome measure based on broader constructs of social play and interaction, rather than frequency of communication, may reduce the influence of these idiosyncratic verbal abilities across students with ASD in evaluating intervention outcomes.

In summary, the current study sought to identify common characteristics of social play and engagement for students with ASD following participation in a peer-mediated intervention. Additionally, understanding how states of social play and engagement are potentially impacted by peer-mediated social interventions is critical to fully

understanding the effects of existing evidence-based practices and strategies. Three research questions were developed to evaluate these issues and contribute to the literature.

1) What are the observed changes in overall rates of social play and engagement for students with ASD following participation in a peer-mediated intervention?

2) What are the observed within-subject changes in social play and engagement for students with ASD following participation in a peer-mediated intervention?

3) What are the within-session sequences of social-play and engagement in students with ASD before and after participation in a peer-mediated intervention?

Method

The current study evaluated social play and engagement as a collateral outcome of a peer-mediated intervention for elementary-age students with ASD. The data for the analysis was derived from the Autism Peer Networks Project, an Institute for Educational Sciences (IES) Goal 2 Development Project focused on peer-mediated social programming for students with ASD conducted by the University of Kansas and the University of Washington in local school districts from 2009 to 2013. Across the four years of the program, 48 students with ASD and approximately 350 typically developing peers participated in the peer-mediated intervention program during Kindergarten and 1st grade. Forty-six teachers and school staff were additionally trained to serve as implementers of the intervention program. All identifying information regarding participants was removed from the dataset, and permission was obtained from the primary investigator to review project data and videotapes for analysis.

Peer-Mediated Intervention Procedures

The peer-mediated intervention followed a manualized format in which intervention scripts were developed and provided to teachers who served as group implementers. Following training from project staff, teachers led peer-mediated social groups three times per week across Kindergarten and First grade while receiving weekly consultation, feedback, and fidelity checks from project staff. The peer-mediated intervention sessions were structured to provide 10-min of systematic instruction and guided practice in the use of age-appropriate social skills, followed by 10-15 min of games and activities designed to promote frequent interactions between students with ASD and their typically developing peers. Session activities included: (1) teacher-led instruction and explanation of a social or communication skill (e.g., requests and sharing, commenting, social niceties, turn taking, organizing play); (2) role-plays demonstrating appropriate social skill use between the teacher and a student in the group; (3) role-plays between students in the group, with prompting provided to the student with ASD as needed, and (4) a game or activity accompanied by adult prompting and reinforcement for appropriate skill use. Social-communication skills targeted during groups included (1) requests and sharing, (2) commenting about self and others, (3) social niceties, and (4) organizing play with others, with each skill targeted for 4-6 weeks before moving on to a new skill. Each participant moved sequentially through the different social skills in the order described above. School staff implementing the intervention monitored the delivery of sessions, reporting an average of 52 social intervention sessions per school year for each participant. See Kamps, Mason, Thiemann-Bourque, Turcotte, Feldmiller, & Miller (2014) for additional information regarding the larger peer-mediated intervention study and materials.

Throughout the Autism Peer Networks Project, the primary dependent variable was frequency or rates of communication as measured by a multi-step coding scheme to capture quantitative data regarding initiations, responses, and specific skill use for students with ASD and their peers. In the primary coding scheme, initiations were identified as a child starting a communication episode spontaneously to one other child or to the group as a whole (i.e., "it's my turn", "the car is going fast," "I like these puzzles"). Responses were defined as communicative acts that were contingent upon a prior response, and occurred within 3-sec of a prior initiation, question, or comment. Following the identification of an initiation or response, communicative acts were coded to indicate the specific social skill used in the interaction (requests, comments, social niceties, turn-taking, or play organizers). Verbalizations that were nonsocial, such as a self-narration or echolalia, were not coded as social communication. In contrast, the present study used a novel-coding scheme focused on characteristics of social play and engagement, providing additional information regarding the effects of the intervention in improving social outcomes. The social engagement data were acquired through a review of video-recordings featuring standardized social assessment probes completed by all study participants at multiple points across the intervention. A coding scheme targeting levels of social-engagement, drawing upon the developmental, social, and behavioral psychology literature, was used to quantify the social interactions of participants across the intervention for analysis.

Participants

Twenty participants were randomly selected from the larger Autism Peer Networks Project for participation in the study, all of who completed participation in the

intervention program. For all participants in the Autism Peer Networks Project, inclusion criteria included 1) a confirmed diagnosis of ASD through records review of clinical evaluations using the *Autism Diagnostic Observation Schedule -ADOS-G, Autism Diagnostic Interview ADI-R,* or the *Childhood Autism Rating Scale* (Lord et al., 2000; Lord, Rutter, & Couteur, 1994; Schopler et al., 1988) or had received an educational diagnosis of ASD by school personnel within a two year periods prior to the start of the study; 2) all participants exhibited functional communication such as the ability to make requests, use two to three word phrases, and be able to follow simple directions; and 3) all participants received a standard score of 50 or greater on the Peabody Picture Vocabulary Test- Fourth Edition (PPVT-IV; Dunn & Dunn, 1997). Four to six typically developing peers were also recruited from each student's general education classroom to participate in the intervention. All participants in the Autism Peer Networks Project completed and returned a signed parental consent form agreeing to all project procedures, which were reviewed and approved by an Institutional Review Board (IRB) at the host institution.

Social Probe Procedures

The present study included an analysis of social play and engagement of students with ASD while participating in a series of standardized 10-min social probes that were video recorded throughout the intervention. Throughout the Autism Peer Networks Program, two to three social probes were collected and videotaped at the beginning, middle, and end of Kindergarten and First Grade to measure changes in social interaction. The social probes were structured to observe naturalistic social interaction and play independent of the instructional peer network intervention sessions. Three students

participated in each social probe, including a student with ASD, and two typically developing peers from the student's peer network. The student with ASD was seated in between the two peers at a table and presented with a standardized set of preselected materials (i.e., a board game, a matching game/activity, and a puzzle) that they could choose to play with. The same materials were used across each probe. Following an initial set of adult instructions to remain seated at the table and play together, no adult guidance or instruction was provided during the 10-minute probes unless a student attempted to leave the table. All social probes were video recorded by project staff for additional analyses.

Social Observation Scale

Building upon prior modifications to Parten's coding scheme (Rubin, 2001; Guralnick & Hammond, 1999), the present study included a multilevel definition of social and nonsocial play to assess the effects of the peer-mediated social intervention. A momentary 10-s time-sampling procedure was used to code each focus child's level of social engagement with two typically developing peers across 10-minute observational sessions. Similar to the coding criteria described by Rubin (2001) and Guralnick and Hammond (1999), coders rated the state of social play and engagement of the student with ASD each 10-s within the following mutually exclusive play categories: unengaged (student is not actively doing anything), solitary (student is playing independently not attending to peers), onlooker (student is actively watching peers play but not participating in the activity), parallel (student is playing alongside peers but not cooperatively), associative (student is playing with others but not in a purposeful activity), and cooperative (students are mutually engaged in activity with a clear purpose and goal).

The total number of observed intervals spent in each respective play state was summed by observation and by participant for analysis. Full coding definitions are presented in Table 1 and a sample observational sheet is presented is Appendix A.

Reliability

Inter-observer agreement was calculated by having a second observer independently code 20% of total sessions across all participants. A point-by-point comparison of the state of social play and engagement coded at each 10-s interval was used to determine consistency between raters, resulting in 60 total observation points per 10-min observation. Reliability scores were determined by dividing the number of 10-s intervals with identical codes of each student's play state by 60. Prior to coding session data, three sample observations were conducted between raters to determine percentage of inter-observer agreement. Following a review and discussion of the coding scheme, initial agreement between raters was 72% (129 of 180 potential intervals). Points of discussion and clarification following these videos included refinements to the distinction between associative vs. cooperative play, and solitary vs. parallel play. In particular, emphasis was placed on requiring intervals coded as cooperative play to include an activity with clear rules or purpose. Parallel play was additionally clarified to emphasize simultaneous use of the same materials without meaningful purpose or ongoing communication between students. Following the review of these coding rules, agreement between raters on three subsequent sample observations was 84% (152 of 180 intervals).

Sessions coded for reliability included one session per participant, and included 10 baseline and 10 post-intervention sessions. The mean percentage of inter-observer agreement across all observations was 86.71%, with a range of 80.0% - 96.67%.

Agreement across each respective state of social play and engagement were 88.34% for cooperative, 82.63% for associative, 80.85% for parallel, 83.13% for onlooker, 90.51% for solitary, and 87.80% for unengaged. These calculations demonstrated 1) the overall percentage of agreement between raters per observation in identifying each student's state of social play and engagement and 2) the agreement between raters in identifying each of the respective states of social play and engagement.

Results

Research Question #1: What are the observed changes in overall rates of social play and engagement for students with ASD following participation in a peer-mediated intervention?

The first analysis focused on the overall observed rates of changes in each of the states of social play and engagement. A series of Wilcoxon matched pairs tests was used to determine the significance of the increases or decreases in the amount of time spent in each state of social play and engagement across the course of the intervention. Six Wilcoxon tests, one for each state (cooperative, associative, parallel, onlooker, solitary, unengaged), were conducted from baseline and post-intervention social probes to determine changes within each respective state of social play and engagement. This analysis provided an indicator of change of the overall levels of social play and engagement with peers across the course of the intervention. The Wilcoxon test is a nonparametric comparison based on ranks of scores rather than raw values to reduce the influence of outlying values or non-normally distributed samples (Kornbrot, 2005). Although nonparametric analyses result in the loss of some of statistical power when compared to parametric methods of analysis its use has been recommended for analysis

of smaller samples or non-normally distributed samples (Wilcox, 2010). Students with ASD are often characterized by widely discrepant and uneven profiles across normative assessments, rating scales, and observational indices (NRC, 2001). As a result of these characteristics, the social idiosyncrasies of ASD typically result in a non-normally distributed sample, which precludes the use of many parametric analyses without violating key assumptions of normality. As a result, the use of nonparametric methods is often most appropriate for populations with ASD to reduce the influence of outlying values.

Summaries of the percentage of total intervals spent in each respective states of social play and engagement reveal several key changes from baseline to post-intervention sessions. Most notably, participants increased time spent in cooperative states of play (0.0% in baseline to 49% in post-intervention), and decreased time spent in solitary states of play (49% in baseline to 17% in post-intervention) and parallel states of play (17% in baseline to 4% in post-intervention). Baseline to post-intervention comparisons for associative, onlooker, and unengaged forms of play were smaller and less immediately apparent. Similarly, results from the Wilcoxon tests indicated that from baseline to post-intervention sessions, the peer-mediated intervention resulted in statistically significant increases in the amount of time spent in cooperative play (W =171, p = <.001), significant decreases in the amount of time spent in parallel play (W =-180, p = <.001), and significant decreases in the amount of time spent in solitary play (W = -210.0, p = <.001). Baseline to post-intervention differences in the observed rates of associative, onlooker, and unengaged were not statistically significant. Full summary data and results of the Wilcoxon tests are presented in Table 3.

Research Question #2: What are the observed within-subject changes in social play and engagement for students with ASD following participation in a peer-mediated intervention?

The second research question focused on identifying the magnitude of change in social play and engagement by each participant after participating in the peer-mediated intervention. Using a weighted scaling procedure to assign scores to each respective state of social play and engagement, a within-subject analysis provided a summary of changes in the most frequently observed or modal state for each participant. The use of similar weighted scoring criteria for play behaviors has been used to evaluate a variety of communication and social skills interventions (Greenwood et al., 2003; Thiemann-Bourque, Brady, & Fleming, 2011). Under the scaling procedure for the current study, the six defined states of social play and engagement were assigned weighted scores according to their rank in the hierarchy (cooperative = 5, associative = 4, parallel = 3, solitary = 1, unengaged = 0). The weighted scores corresponding to the most frequently observed, or modal states, during baseline and post-intervention sessions allowed for a calculation of the mean degree of improvement observed across the different states of social play and engagement across participants. During baseline sessions, the majority participants primarily engaged in solitary play, with a mean score of 2.1 using the weighted scoring procedure. The observed baseline states across all participants included solitary (n = 12), associative (n = 6), and parallel (n = 2) engagement. During post-intervention sessions, however, a majority of participants (75%) improved upon the modal state observed during baseline sessions. The observed post-intervention states across all participants included cooperative (n =11), associative (n = 6), and solitary (n =

3). The mean weighted score of post-intervention sessions was 4.1, with mean improvement of +2 from baseline sessions, suggesting that participants on average increased their modal state of engagement by two states. A summary of the full weighted scores for all participants in baseline and post-intervention sessions are presented in *Figure 3.*

Research Question #3: What are the within-session sequences of social play and engagement in children with ASD before and after participation in a peer-mediated intervention?

The final research question focused on the sequences of social play and engagement observed during baseline and post-intervention sessions. Each participant's within-session patterns of responding across the two 10-minute observations per phase were graphed, with the Y-axis corresponding to the respective levels of the hierarchy of social participation. Graphs were then reviewed using visual analysis to identify reoccurring or notable trends across participants from baseline to post-intervention sessions. Several notable findings were observed across participants, including both the number of transitions observed during sessions and the within-session patterns of responding across different states of engagement. Notably, post-intervention sessions were characterized by fewer transitions between states of social play and engagement than baseline sessions, which often included frequent transitions amongst states. Baseline sessions across all participants included 350 total between-state transitions, with a mean of 17.5 transitions per participant. In contrast, post-intervention sessions included 236 total between-state transitions, or a mean of 11.8 transitions per participant. These changes suggest that post-intervention sessions included participants spending longer

intervals, or a greater duration of time, in respective states of engagement and fewer changes in the types of social interactions occurring.

Visual analysis of participant graphs also revealed four primary patterns of responding of within-session behaviors during baseline and post-intervention sessions. The first and most immediately observable pattern included 10 participants characterized by clear changes in within-session patterns of engagement involving a change from nonsocial forms of play during baseline sessions towards cooperative or associative forms of play in post-intervention sessions. These specifically included Participants 102, 103, 125, 127, 130, 131, 150, 156, 157, and 163 who are visually presented in Figures 2, 3, 4, 6, 9, 10, 14, 17, 18 and 21 respectively. Baseline sessions for these participants were typically characterized by variable rates of engagement across unengaged, solitary, onlooker, or parallel with occasional or brief transitions into associative play, and no observed instances of cooperative play. In contrast, post-intervention sessions for each of these participants featured multiple instances of associative or cooperative play, in many cases lasting for the majority of the observed sessions. These participants offer the clearest demonstration of the effects of a peer-mediated intervention in facilitating the social skills required for sustained, cooperative play with typically developing peers. Additionally, the described participants who demonstrated these gains presented with a wide range of verbal abilities and perceived severity of social impairments as indicated by standardized assessments. The range of receptive vocabulary skills as measured by the PPVT-IV standard score for these participants was 54-104 (severe language impairment through average abilities), and range of severity of autistic symptoms as measured by the CARS was 23-41 (minimal or no autistic symptoms through severely

abnormal). Collectively, these findings suggest that some students with ASD are able to engage in cooperative group activities with peers regardless of verbal abilities or ASD severity following the delivery of systematic and structured social interventions.

The second observed pattern of responding included five participants who began baseline sessions engaging in higher forms of social play and engagement, and showed notable improvement in social participation as measured by post-intervention sessions, specifically in transitioning from associative to cooperative forms of play. Participants 151, 152, 158 162, and 136 each primarily engaged in associative forms of play during baseline, indicating some degree of initial social competence and peer interaction. Graphs for these participants are presented in Figures 13, 15, 16, 19, and 20 respectively. Following participation in the peer-mediated intervention, however, social observations were characterized primarily by cooperative forms of play with peers. These participants also presented with a range of abilities and perceived impairments as indicated by standardized assessments, with a range of receptive vocabulary skills as measured by the PPVT-IV of 72-103 and a range of perceived autistic severity as measured by the CARS of 36-41.5.

A third unique pattern of responding included three participants who demonstrated clear differences in behaviors between the two observations that comprised their baseline or post-intervention data. For example, Participant 128's data, presented in Figure 7, included an initial post-intervention session primarily featured solitary play. This occurred following an interaction at the beginning of the session in which a peer elected not to play with the student with ASD or the additional peer at all, who then each transitioned to individual activities for the remainder of the 10-min session. The

subsequent post-intervention session, however, included multiple peer interactions and transitions to associative or onlooker forms of engagement. An additional example of disparities between sessions can be observed in Participant 132, presented in Figure 11, who spent the initial post-intervention session engaged in solitary play and was unresponsive to multiple attempts from peers to engage in a group activity. During the second post-intervention observation, however, the participant easily engaged with their peers following an initial request and the remainder of the session primarily included cooperative and associative play. A final example of discrepancies between the two post-intervention sessions was observed in Participant 164, presented in Figure 22, who spent the majority of the initial post-intervention session engaged in cooperative play. During the subsequent post-intervention session, however, solitary play was primarily observed after the student began perseverating on a preferred character included on one of the matching cards. These examples illustrate the impact of other variables on the quality of social interactions, such as peers electing not to play with students with ASD, a particular toy or set of materials causing a student to prefer to play alone, or other unknown or unmeasured distal variables reducing the likelihood of sustained social interactions.

A final pattern of responding observed in two participants indicated minimal or less apparent changes in social interaction from baseline to post-intervention sessions. Participant 126, presented in Figure 5, primarily engaged in solitary forms of play both in baseline and post-intervention sessions. This participant notably had severe language delays and impairments (PPVT-IV SS = 53), indicating that additional language or communication support (i.e., assistive devices, picture cards) may have been necessary to support social interactions. Participant 135, presented in Figure 12, also showed limited

change from baseline to post-intervention sessions. These sessions, however, were primarily characterized by associative play in both time points, indicating other unknown variables of the social interaction or the social context of the video probe may have limited advanced cooperative play.

Discussion

The purpose of current study was to evaluate social play and engagement as an outcome of a peer-mediated intervention for students with ASD. Although students with ASD show a clear need for social skills intervention and research has increasingly emphasized the importance of providing systematic social skills instruction, concerns have been raised regarding existing methods of measuring intervention outcomes (Bellini, 2009; Bolte & Diehl, 2013). The current study used a social hierarchy drawing upon Parten's (1932) scale of social participation to measure the social behaviors of students with ASD during standardized social probes before and after participation in peer-mediated intervention. The results of the analysis included significant increases in the amount of time of students with ASD spent engaged in cooperative play, and reductions in the amount of time spent engaged in solitary play. Results additionally indicated that participants on average improved the type of play they primarily engaged in during post-intervention sessions. These results address a notable gap in the ASD literature that has called for an increased focus on social play and engagement as an intervention outcome (Wolery & Garfinkle, 2002; Strain & Schwartz, 2002). The present study also expanded the line of research utilizing Parten's (1932) observational framework of social participation to students with ASD, and utilized a novel analytic method to evaluate the effects of a peer-mediated intervention. As a result of these

positive outcomes, additional support can be provided for the use of peer-mediated interventions as an evidence-based strategy for increasing the social competence of students with ASD. Additionally, the findings expand the understanding of the effects of peer-mediated interventions to previously unexplored aspects of social engagement. These results could be especially beneficial in providing support for the use of peer-mediated interventions for students with ASD with lower verbal abilities or limited communication skills, who may appear less responsive to interventions when measured by the frequency of specific social-communicative targets.

Results of the current study also lend importance to the continued study of engagement as a outcome variable of social interventions. Several issues are noted in the literature on existing outcome measures, including relying primarily on verbal behaviors (Bellini, 2009 & Bolte & Diehl, 2013), with relatively little attention to social play, engagement, and other adaptive behaviors as intervention outcomes (Strain & Schwartz, 2002, Wolery & Garfinkle, 2002). Understanding the relationship between social, adaptive, and verbal behaviors, however, remains an important area for future studies. To understand this relationship in the present study, a correlational analysis between the change-scores obtained in Research Question #2 and raw scores obtained from several standardized assessments (PPVT-IV, Socialization and Communication Domains of the VABS-CE) from baseline to post-intervention were conducted to determine if changes in social play and engagement were related to improvements in verbal abilities or adaptive skills. Correlations for the PPVT-IV (r = -.17), VABS-CE Socialization Domain (r = -.22), and VABS-CE Communication Domain (r = -.21) were low, suggesting the observed changes in social engagement occurred

independently of any potential changes in receptive verbal abilities or adaptive behavior skills.

In addition to being characterized by higher forms of social play and engagement, it is also notable that post-intervention sessions were characterized by fewer transitions between states than baseline sessions. Specifically, many participants engaged in episodes of cooperative play that lasted for several minutes, or even the majority of each 10-min session with minimal transitions to other states. These findings are consistent with the literature emphasizing the unique characteristics of cooperative play and its importance in facilitating social interactions (Rubin, Bukowski, & Parker, 2006). Specifically, cooperative play may lead to longer interactions due to the time required to organize a cooperative activity, and require the use of sophisticated social interactive skills required to sustain cooperative play episodes (i.e., turn taking, play organizing, attending to the behaviors of others). In the present study, intervals featuring longer periods of cooperative play were typically characterized by interactions in which students with ASD and their peers had organized and structured a formal game with rules, turns, or a clear objective. These outcomes suggest that the use of many of the skills targeted during the peer-mediated intervention sessions (i.e., requesting and sharing items, commenting on activities of others, organizing a game) resulted in sustained cooperative engagement between students with ASD and their peers. Intervals featuring cooperative play may also be more likely following intervention due to specific features of games or activities that require social interaction skills (i.e., asking a peer for a game piece, keeping track of turns or points) to initiate or maintain an activity over longer periods of time. These findings emphasize the importance of providing students with ASD the skills

necessary to initiate and sustain cooperative play with peers, leading to longer social interactions requiring minimal adult assistance.

Limitations

The results of the analysis in the present study, however, should be interpreted in light of several notable limitations to guide future research. Primarily, the current study included a relatively small sample size and a within-group analysis to determine changes following intervention. Future studies that either include larger samples of students with ASD or utilize methods of obtaining normalized distributions of participant variables may make further contributions to the literature. This could be specifically achieved either through recruiting larger samples of students with ASD, or targeting specific subtypes of students with ASD (i.e., students with high functioning ASD with communication, cognitive, or adaptive behavior skills within the average range) to limit variability within a sample. Additionally, future studies that include a control group of students with ASD who did not participate in a social intervention would enable additional comparisons of intervention effects and changes in social behaviors.

An additional limitation to the study was that not all participants showed notable improvement in social behaviors during post-intervention sessions, and other participants who showed some improvement but rarely engaged in cooperative play. These findings suggest that participation in a peer-mediated intervention may not result in improved social engagement for all students with ASD. Additional research may be helpful in identifying more specific profiles of students with ASD who may benefit from peer-mediated programming, and those who require additional supports or alternative intervention strategies.

A final limitation of the current study was measuring the observed changes in social behaviors only within one standardized setting. Future research could include more a comprehensive application of the coding scheme used in the current study to measure the generalized effects of peer-mediated interventions. For example, observations conducted during recess, social play centers, lunch, or other unstructured activities that include access to typically developing peers would provide valuable information regarding generalized intervention effects in related settings. Additionally, expanding the use of the coding scheme in the present study to these generalized settings would provide information regarding the types of social behaviors that characterize interactions for students with ASD across common educational environments.

Future Directions

Although the present study descriptively identified when different changes in social engagement occurred within sessions, future studies could also focus on precise analysis of the types of social events that precede or follow key changes in social engagement. This would include the identification of specific antecedent or consequent events observed during sessions and their effects on the quality of social interactions. For example, receiving negative attention from peers may immediately precede a period of solitary play for a student with ASD, while receiving positive attention from peers may lead to cooperative play between students. Similarly, analysis of these events could focus on the specific behaviors that occur during sustained periods of cooperative play and interaction (i.e., frequent turns between peers, verbal praise of others, commenting on others play, etc.) and potentially maintain these positive interactions over longer periods of time. The identification of these various types of social events or interactions that lead

to different forms of social engagement would provide additional information regarding specific skills to target during intervention to maintain sustained social interactions.

A final direction for future studies may also include the use of a similar outcome variable of social play and engagement as a formative measure during peer-mediated interventions. Although the present study included a measurement of social engagement across two time-points (baseline and post-intervention), including additional points of measurement of social engagement behaviors and longer observations within settings would also be beneficial. This would specifically enable an ongoing evaluation of changes in social behaviors throughout the delivery of an intervention, and allow for a more nuanced analysis of growth in social engagement skills over time. Ongoing analysis of social engagement could also inform the development of individualized social intervention content to meet the idiosyncratic needs of many students with ASD. For example, students who are primarily unengaged during baseline sessions, or show disruptive or avoidant behaviors when in proximity to peers, it may be inappropriate to immediately target more complex social interaction skills. Instead, students demonstrating these behaviors may instead benefit from instruction on basic social and attending skills, intended to facilitate parallel or onlooker play, and reinforce proximity to peers. In contrast, students with ASD who are observed primarily engaging in parallel, onlooker, or associative play during baseline sessions demonstrate many of the prerequisite skills and readiness to interact with peers (i.e., attending to the play of others, commenting or describing toys to others), but may struggle with more complex social or pragmatic skills required for cooperative play (i.e., deciding on rules, game objectives, taking turns, etc.). In these instances, intervention content could be adjusted to

immediately target more complex or specific social-communicative skills as an intervention goal to facilitate the development of cooperative play behavior.

Collectively, the current study represents initial contribution towards the study of states of social play and engagement as an intervention outcome for students with ASD, but clearly additional research will be needed to further study these constructs. The outcomes of the current study contribute to the literature by identifying evidence-based interventions for students with ASD and in providing a novel approach to capturing critical social and behavioral changes occurring during the course of peer-mediated intervention. The results of the study support both peer-mediated interventions as a promising strategy for students with ASD, and the use of an engagement-based coding scheme to measure social intervention effects. Additional research focusing on the social play and engagement with peers will continue to develop the research literature and promote positive outcomes for students with ASD.

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Table 1. Participant Demographics

ID	Ethnicity	Gender	CARS	PPVT	SRS TS	VABS-CE
102	African-American	M	36.5	54	73	56
103	White	M	29	90	63	75
125	White	M	35	74	77	62
126	African-American	M	38.5	53	75	55
127	White	M	39.5	88	71	90
128	White	M	33	87	60	77
130	White	F	23	104	59	75
131	White	M	35	86	51	103
132	White	M	27.5	77	65	83
135	White	M	31.5	103	63	87
136	White	F	36	72	53	96
150	White	M	39	79	53	83
151	White	M	42	91	53	115
152	White	M	41.5	94	52	84
156	White	M	35	92	75	65
157	White	M	41	82	68	82
158	African-American	M	41	86	63	83
162	White	M	34	103	61	59
163	Hispanic	M	34	71	57	73
164	White	M	36.5	77	74	82

Note. CARS = Childhood Autism Rating Scale Total Score, PPVT = Peabody Picture Vocabulary Test-Fourth Edition Standard Scores, SRS-TS = Social Responsiveness Scale-Second Edition Teacher Total T-Scores, VABS CE = Vineland Adaptive Behavior Scale – Classroom Edition, Adaptive Behavior Composite Standard Score

Table 2. Social Engagement Codes

State	Definition
Cooperative	Student is actively engaged with peer(s) in an activity with a clear purpose and/or shared goal. Observable behaviors may include completing a game or puzzle together, taking mutual turns, a competitive activity, planning a game, discussing the rules of a game with clear objectives that can be followed
Associative	Student is interacting with peer(s) but in an activity in which there is no discernable goal or purpose to their play. Observable behaviors may include simultaneous play with the same materials, exchanging items, brief comments or description of play and activities, or conversational exchanges that do not involve a purpose and/or goal.
Parallel	Student independently plays alongside peer(s) using related materials, each simultaneously but separately engaged in activities, but not *with* those around them. Observable behaviors may include "parallel speech" or verbalizing thoughts for the benefit of those around them without specifically directing speech towards them for any specific purpose.
Onlooker	Student is not actively engaged in an activity with peer(s), but is clearly watching the actions of others at the table. Observable behaviors include orientation of eye gaze towards peer(s) indicative of attending to their behavior, interactions, or manipulations of objects, toys, and materials. Student may offer brief comments, laugh, and/or respond with the events of the activities of other children, but does not become an active participant in the actual game or activity.
Solitary	Student is engaged in an independent activity and not attending to the behaviors or interactions of peer(s). Observable behaviors may include intense fixation on an individual object or activity, paying little to no attention to other materials or those around them.
Unengaged	Student is not actively engaged in any interactions with others or materials, toys, or activities. Observable behaviors may include the absence of focus or intent in actions, staring blankly, facing away from others, nonfunctional behaviors (i.e., stereotypy, tapping items on table) attending to other parts of the room, or putting their head down on the table.

Figure 1. Aggregate Changes in Social Engagement from Baseline to Post-Intervention

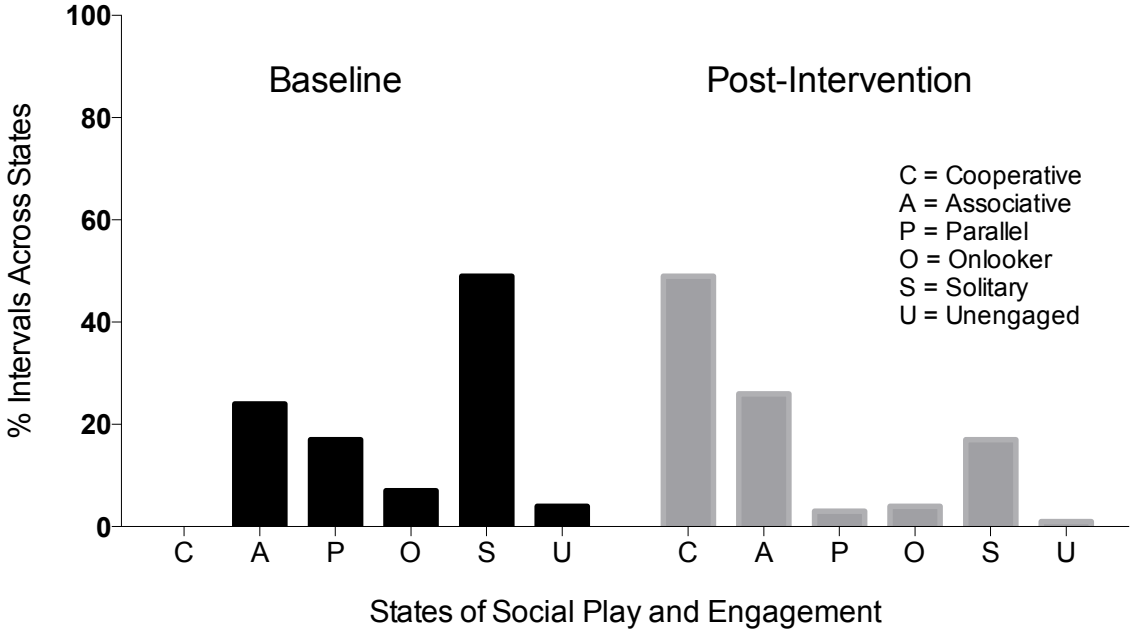


Table 3. Wilcoxon Matched Pairs Tests Results of Baseline and Post-Intervention

	Percentage of Baseline Intervals	Percentage of Post-Intervention Intervals	*W*	*p*-value
Cooperative	0%	49%	171.0	<.001
Associative	24%	26%	5.0	0.93
Parallel	17%	3%	-181.0	<.001
Onlooker	7%	4%	-50.0	0.29
Solitary	49%	17%	-210.0	<.001
Unengaged	4%	1%	-43.0	0.03

Table 4. Weighted-Score Changes in Modal States

ID	Modal Baseline State	Baseline Weighted-Score	Modal Post-Intervention State	Post-Intervention Weighted-Score	Change
102	Solitary	1	Associative	4	+3
103	Solitary	1	Cooperative	5	+4
125	Solitary	1	Cooperative	5	+4
126	Solitary	1	Solitary	1	0
127	Solitary	1	Cooperative	5	+4
128	Solitary	1	Solitary	1	0
130	Solitary	1	Associative	4	+3
131	Parallel	3	Associative	4	+1
132	Solitary	1	Solitary	1	0
135	Associative	4	Associative	4	0
136	Associative	4	Cooperative	5	+1
150	Parallel	3	Cooperative	5	+2
151	Associative	4	Cooperative	5	+1
152	Associative	4	Cooperative	5	+1
156	Solitary	1	Cooperative	5	+4
157	Solitary	1	Cooperative	5	+4
158	Associative	4	Associative	4	0
162	Associative	4	Cooperative	5	+1
163	Solitary	1	Associative	4	+3
164	Solitary	1	Cooperative	5	+4
Mean	-	2.1		4.1	+2

Figure 2. Within-Session States Across 10-s Intervals for Participant 102

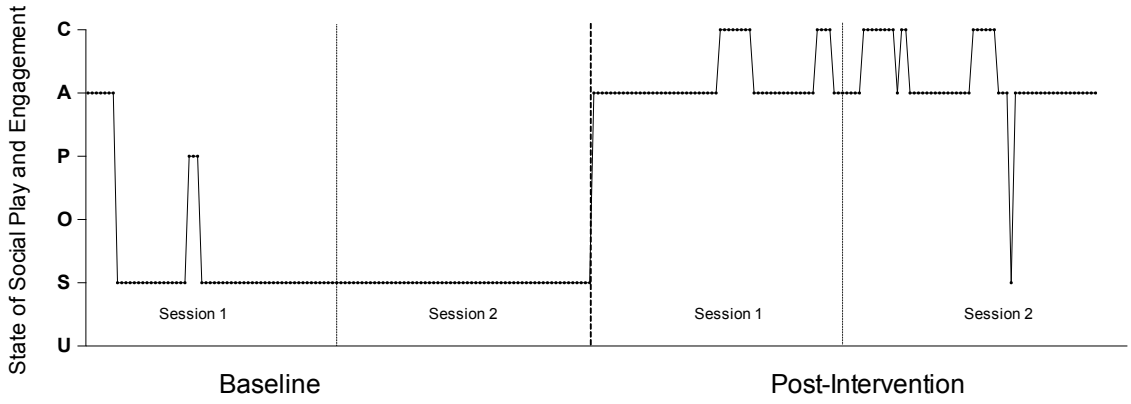


Figure 3. Within-Session States Across 10-s Intervals for Participant 103

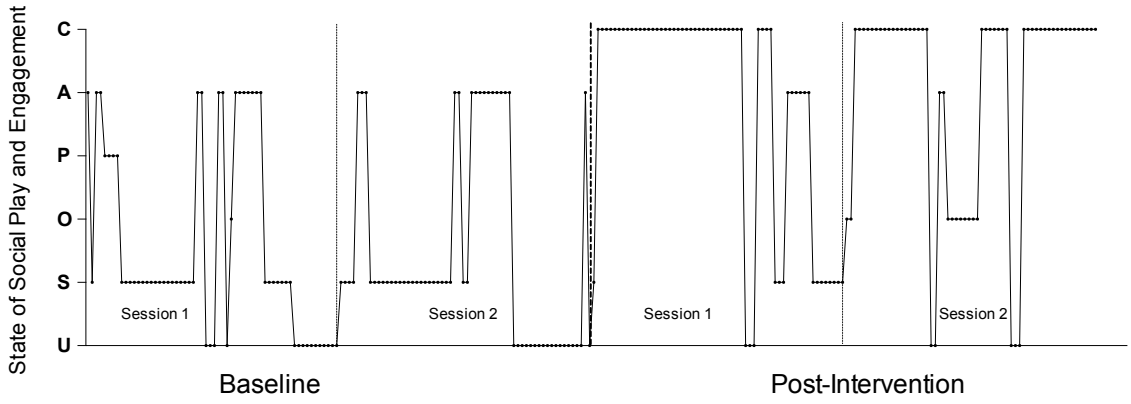


Figure 4. Within-Session States Across 10-s Intervals for Participant 125

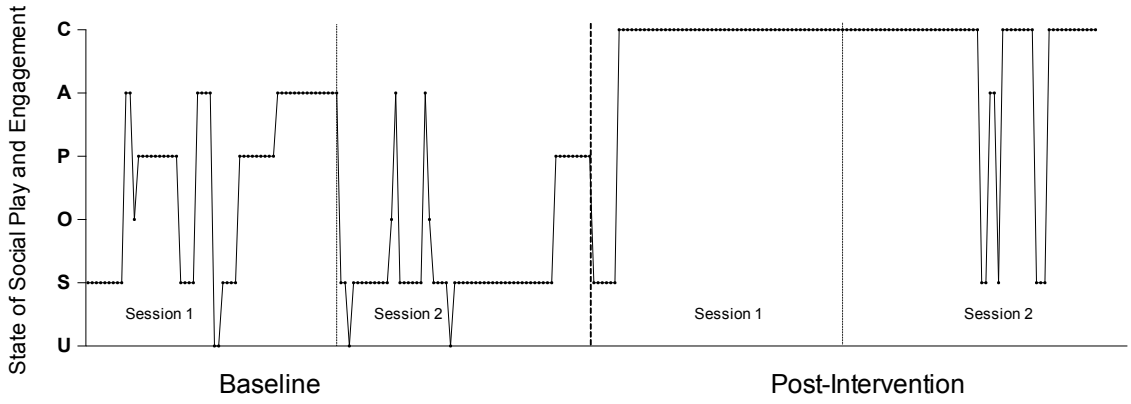


Figure 5. Within-Session States Across 10-s Intervals for Participant 126

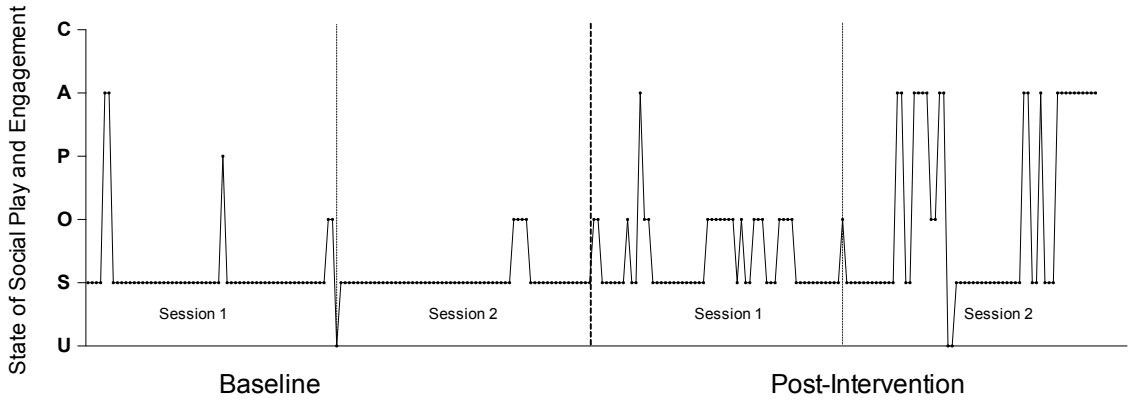


Figure 6. Within-Session States Across 10-s Intervals for Participant 127

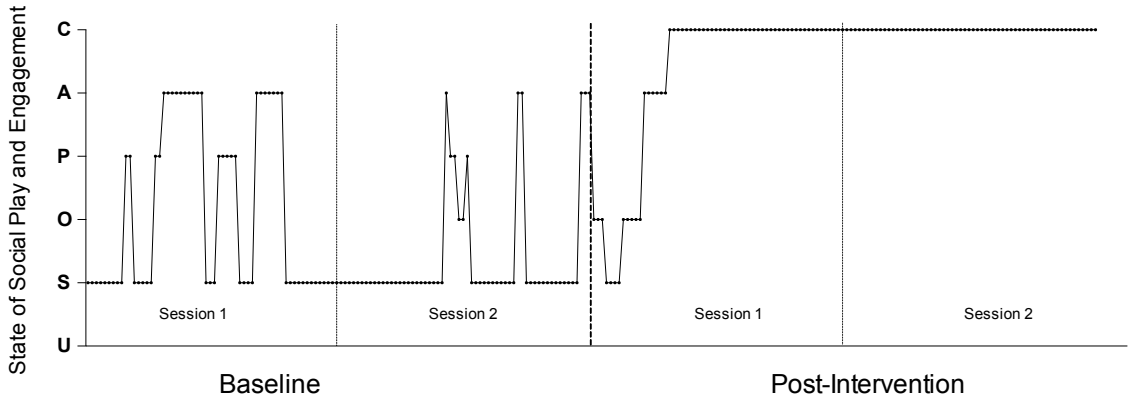


Figure 7. Within-Session States Across 10-s Intervals for Participant 128

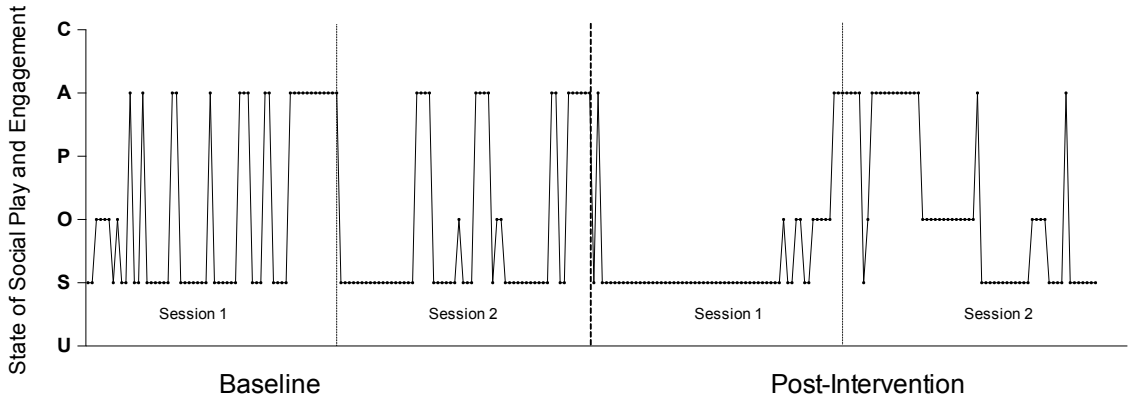


Figure 9. Within-Session States Across 10-s Intervals for Participant 130

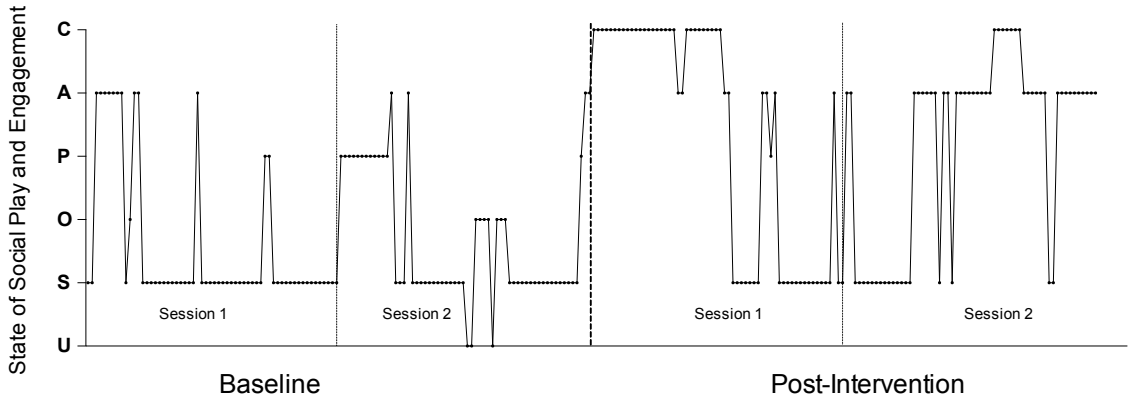


Figure 10. Within-Session States Across 10-s Intervals for Participant 131

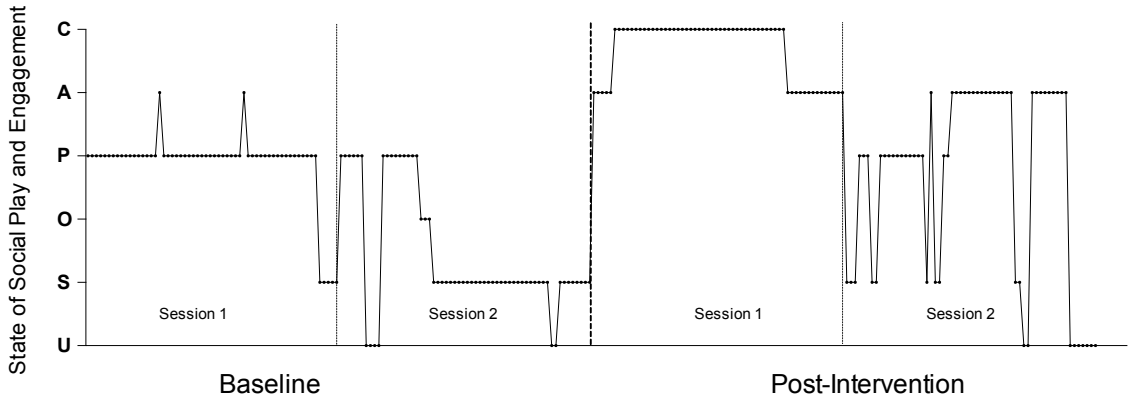


Figure 11. Within-Session States Across 10-s Intervals for Participant 132

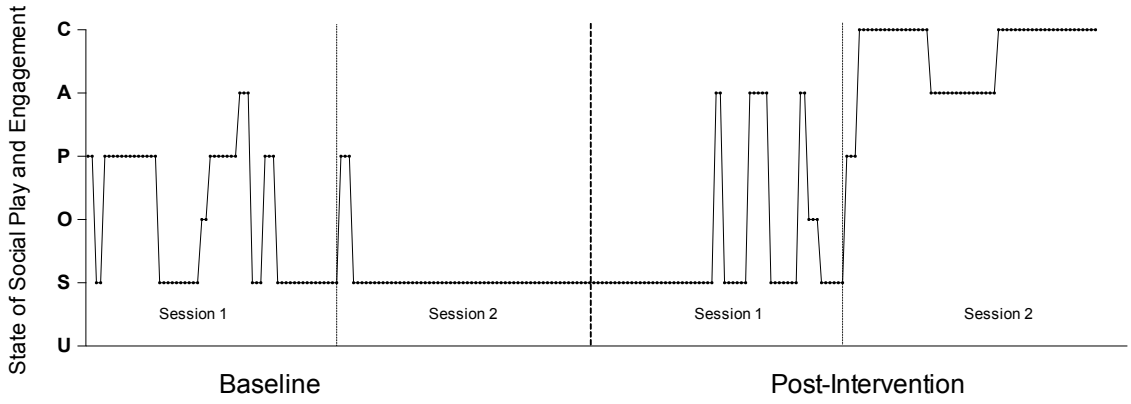


Figure 12. Within-Session States Across 10-s Intervals for Participant 135

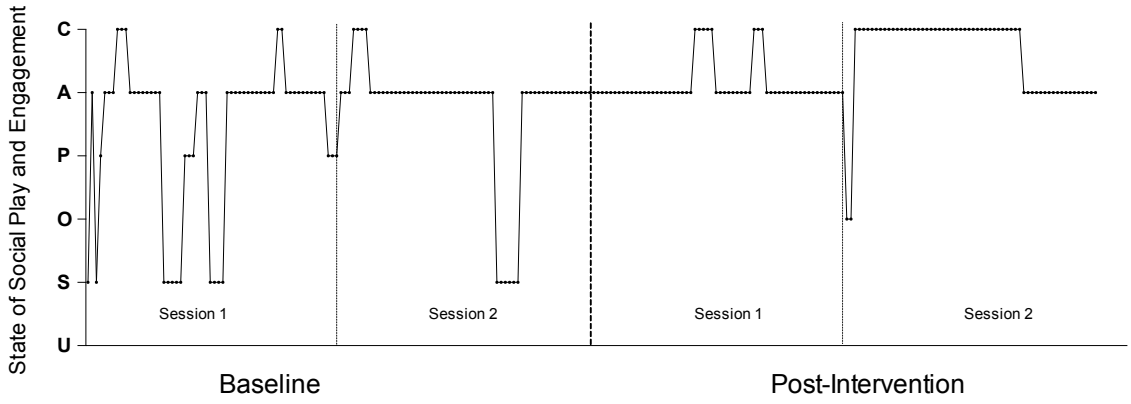


Figure 13. Within-Session States Across 10-s Intervals for Participant 136

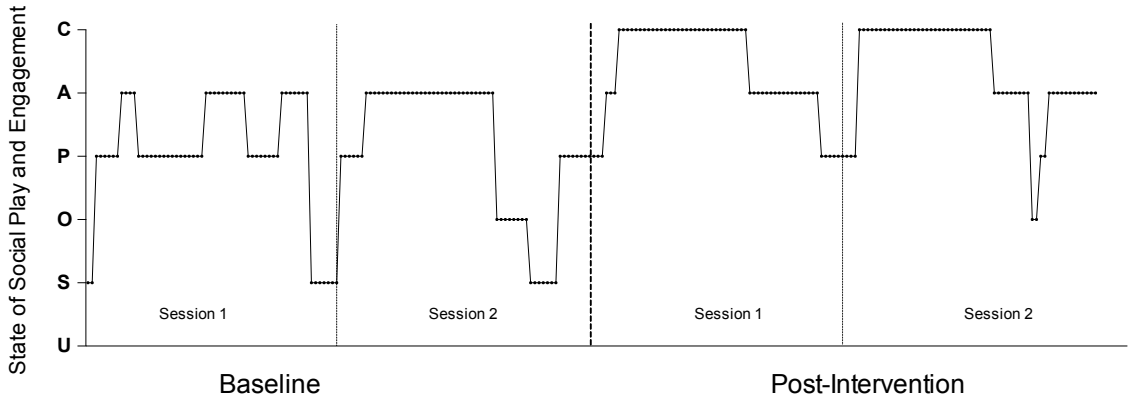


Figure 14. Within-Session States Across 10-s Intervals for Participant 150

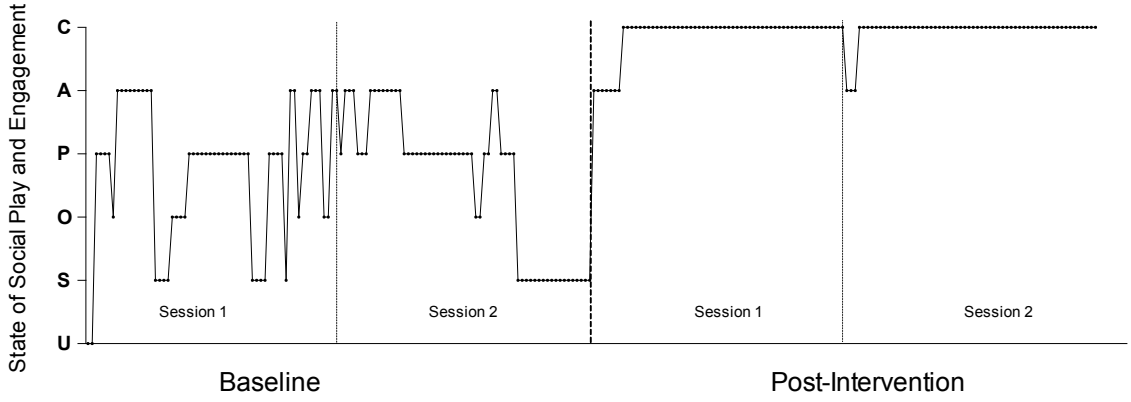


Figure 15. Within-Session States Across 10-s Intervals for Participant 151

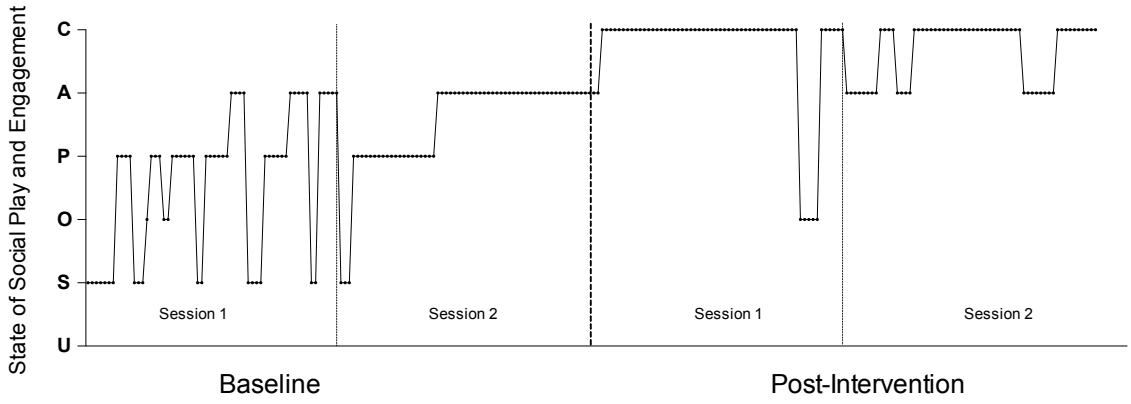


Figure 16. Within-Session States Across 10-s Intervals for Participant 152

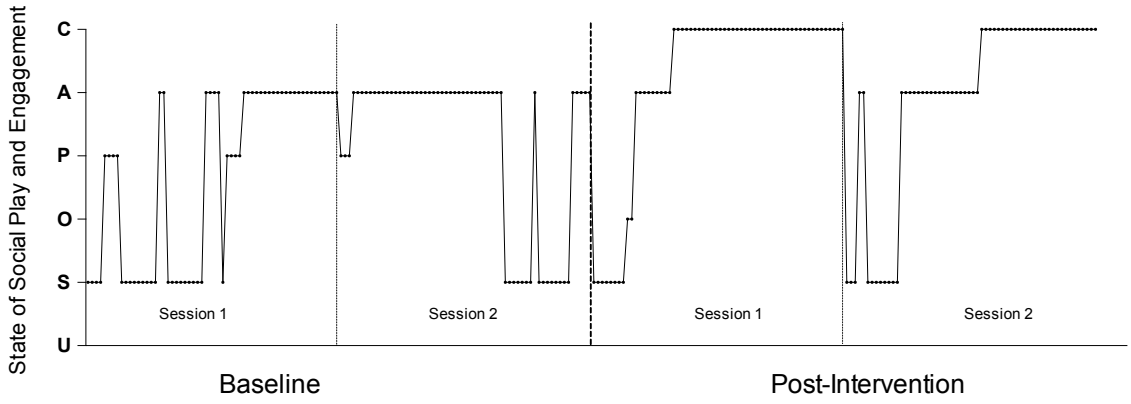


Figure 17. Within-Session States Across 10-s Intervals for Participant 156

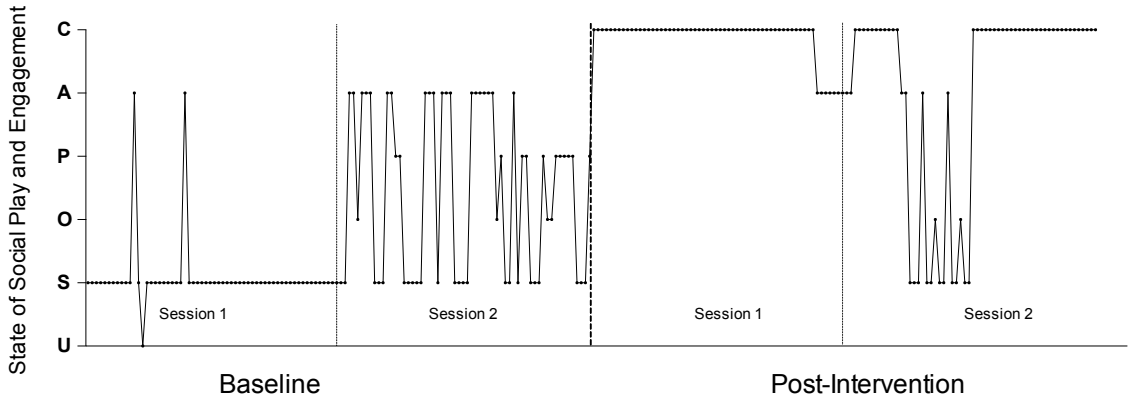


Figure 18. Within-Session States Across 10-s Intervals for Participant 157

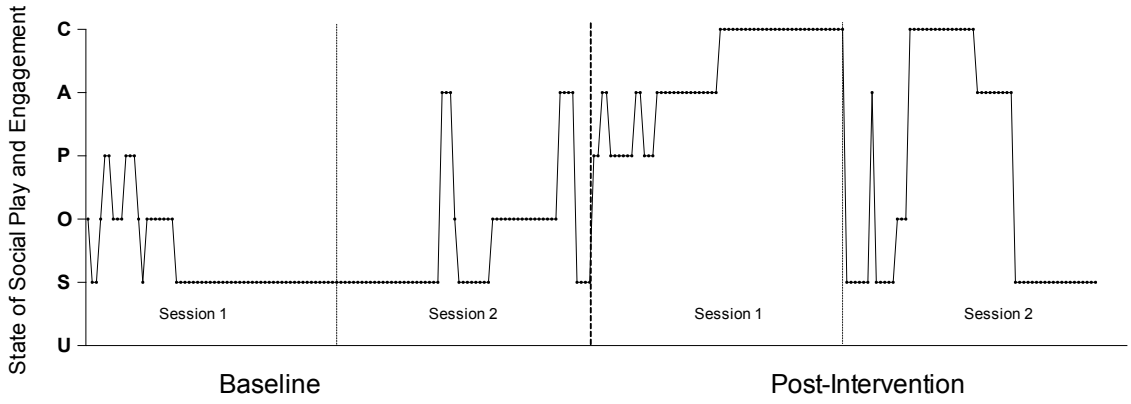


Figure 19. Within-Session States Across 10-s Intervals for Participant 158

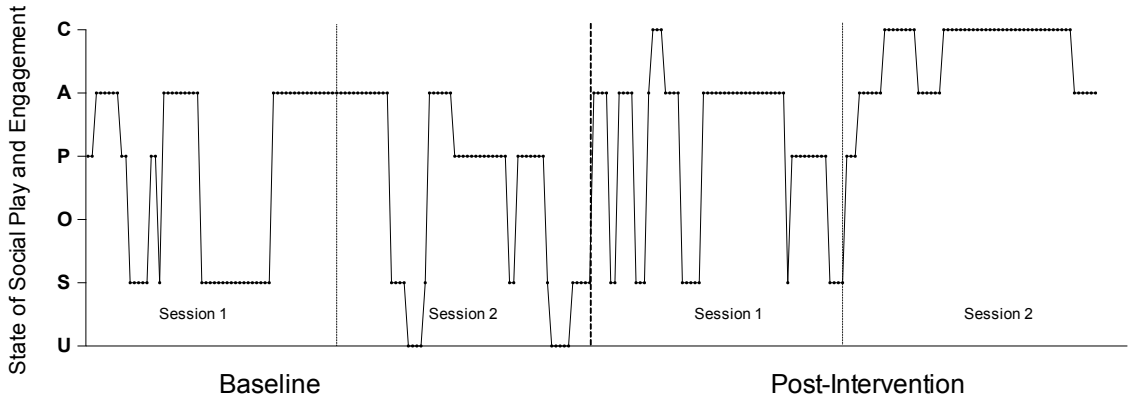


Figure 20. Within-Session States Across 10-s Intervals for Participant 162

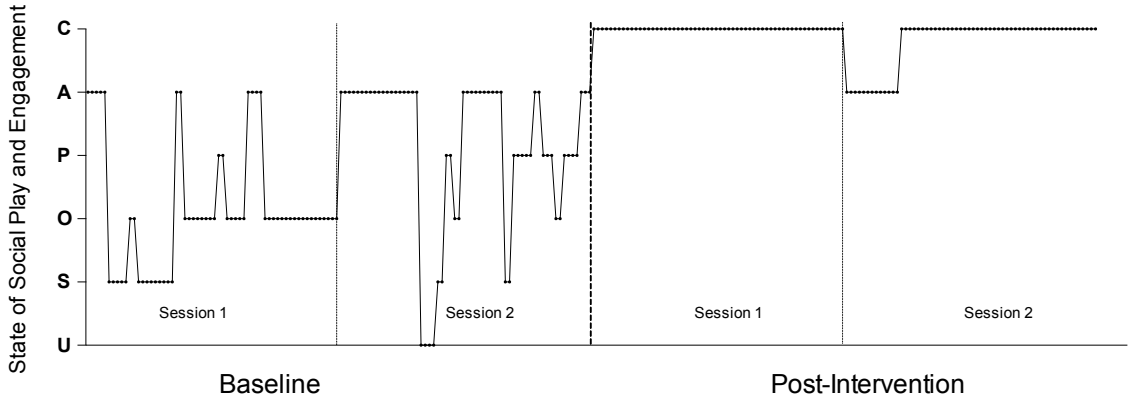


Figure 21. Within-Session States Across 10-s Intervals for Participant 163

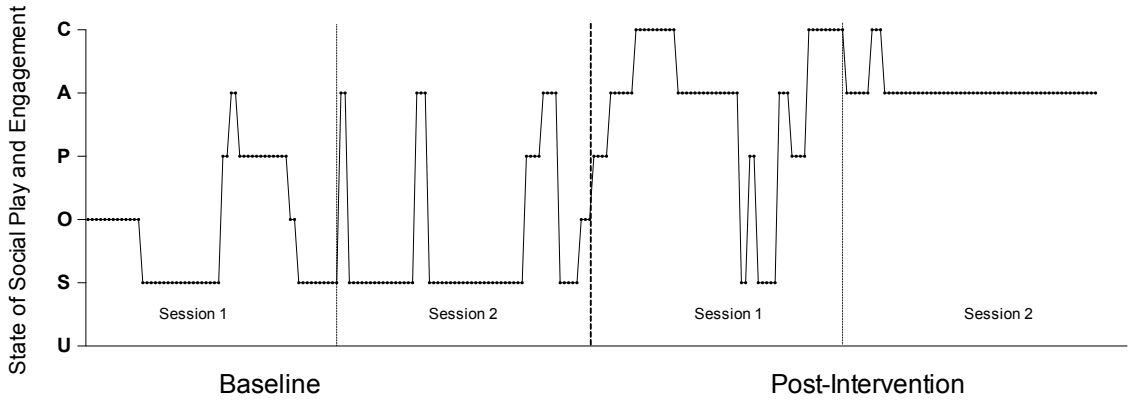
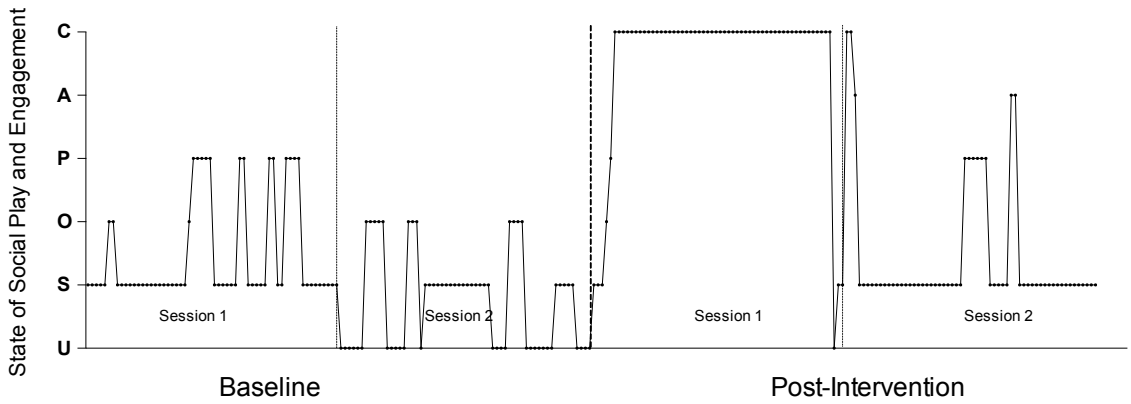


Figure 22. Within-Session States Across 10-s Intervals for Participant 164



Appendix A: Social Play and Engagement Coding Sheet

ID: _____ **Coder:** _____ **Coding Date:** _____

Session 1:

m/s	:10	:20	:30	:40	:50	:60	C	A	P	O	S	U
0	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
1	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
2	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
3	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
4	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
5	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
6	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
7	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
8	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
9	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
						TOTAL						

Session 2:

m/s	:10	:20	:30	:40	:50	:60	C	A	P	O	S	U
0	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
1	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
2	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
3	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
4	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
5	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
6	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
7	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
8	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
9	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
						TOTAL						

Session 3:

m/s	:10	:20	:30	:40	:50	:60	C	A	P	O	S	U
0	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
1	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
2	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
3	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
4	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
5	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
6	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
7	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
8	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
9	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
						TOTAL						

Session 4:

m/s	:10	:20	:30	:40	:50	:60	C	A	P	O	S	U
0	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
1	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
2	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
3	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
4	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
5	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
6	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
7	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
8	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
9	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U	C A P O S U						
						TOTAL						

Notes_____